Pontifícia Universidade Católica
do Rio de Janeiro

Felipe Queiroz de Carvalho

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Preventing the spread of bank failures in the financial system: An analysis of recent episodes

Monografia de Final de Curso

Prof. Yvan Becard
Advisor
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Rio de Janeiro, November, 2023

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Declaro que o presente trabalho é de minha autoria e que não recorri para realizá-lo, a nenhuma forma de ajuda externa, exceto quando autorizado pelo professor tutor.

I declare that this work is my own and that I did not use any form of external help to carry it out, except when authorized by the advisor.

As opiniões expressas neste trabalho são de responsabilidade única e exclusiva do autor.

The opinions expressed in this work are the sole and exclusive responsibility of the author.

À Marcia e Edival,
meus pilares inabaláveis que eu tenho orgulho de poder chamar de pais,
cujo amor e apoio foram a força motriz desta jornada acadêmica.

To Marcia and Edival,
my unwavering pillars whom I proudly call my parents,
whose love and support were the driving force behind this academic journey.

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Abstract

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This paper seeks to assess the impact of regulatory responses implemented by authorities in the United States and other affected countries following the 2023 banking crisis. This crisis was set off by the collapse of Silicon Valley Bank (SVB) and subsequent failures of Signature Bank and Credit Suisse. Employing a narrative approach and analyzing the events and corresponding measures, the study draws on qualitative and quantitative data from different sources. It references the classification and historical context of policy measures outlined by Metrick and Schmelzing in 2021. The objective of this work is to offer policymakers and market participants a better insight into crucial actions that can be taken to prevent the spread of systemic risks within the banking sector, particularly in response to vulnerabilities in specific financial institutions.

Keywords

Banking; Bank Failures; Monetary Policy; Market Participants; Silicon Valley Bank; Credit Suisse; Signature Bank; Systemic Risk.

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List of Abbreviations

CDS – Credit Default Swap
CS – Credit Suisse
DW – Discount Window
FDIC – Federal Deposit Insurance Corporation
Fed – Federal Reserve System
FHLB – Federal Home Loan Bank
FRC – First Republic Bank
MBS – Mortgage-backed securities
SBNY – Signature Bank of New York
SNB – Swiss National Bank
SVB – Silicon Valley Bank
WSJ – The Wall Street Journal

1

Introduction

The modern banking system is characterized by a sizeable interconnectivity of their members and by a big, and growing, digitization and agility. The once tenuous (and sometimes dangerous) task of moving substantial sums of money currently is mostly seamless, quick, and easy.

This scenario is largely positive for society, with both clients and banks benefiting from more efficiency in the system. However, in times of stress, this can be the ideal scenario for the occurrence of a bank run and must be avoided.

The speed upon information gets propagated on social media also plays a large role in this situation: niched and (originally) small audience rumors can be transmitted to an exponential number of people in a few moments.

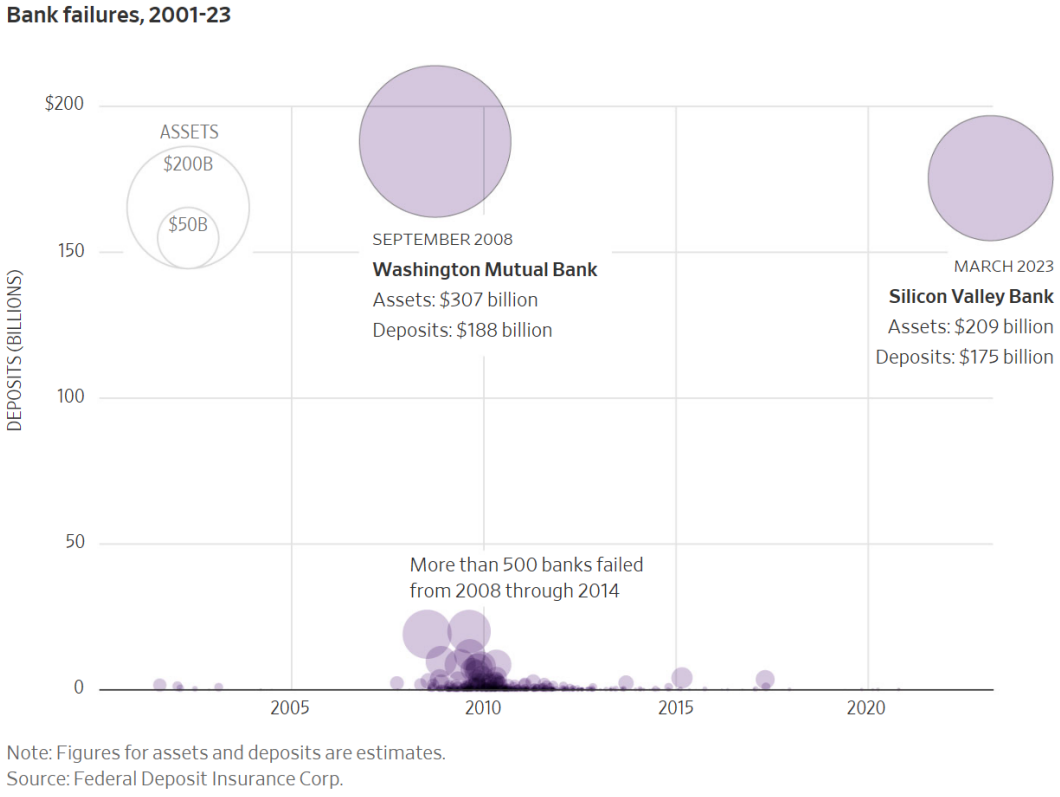

Figure 1.1: The banking crises visualized. (Santilli and James 2023)

On March, 2023, all the above factors were present on the banking run that, subsequently, led to the failures of Silicon Valley Bank (SVB), Signature Bank (SBNY), and Silvergate Bank. After weaknesses in the balance sheet of SVB were detected and mentioned on social media vehicles such as Twitter,

an *en masse* deposit withdrawal started in the bank. On Thursday, March 9, 2023, depositors tried to withdraw $42 billion – about 25% of total deposits –, or 4.2bln in each banking hour. At the end of the day, the bank could not cover their outgoing payments at the Fed and was put into receivership at the morning of the next day[1]. (Ensign, Driebusch, and Bobrowsky 2023)

The preliminary analysis of this event shows the weight that digital transfers and the prominence of social media have in modern day episodes of banking stress.

It is relevant to state that this incident is very distinct from the 2008 financial crisis. Even though the regulators in both cases were not proactive on identifying the problems before they erupted, in the more recent episode the stress was predominantly localized, not systemic as it was in the '08 GFC. With that being said, the failure of 3 banks (SVB, Signature, and First Republic) that were relatively big in terms of assets and deposits, the public as a whole has, at first, less trust in the banking system. That can lead to a generalized episode of stress or even a crisis if no relevant actions are taken by the regulators.

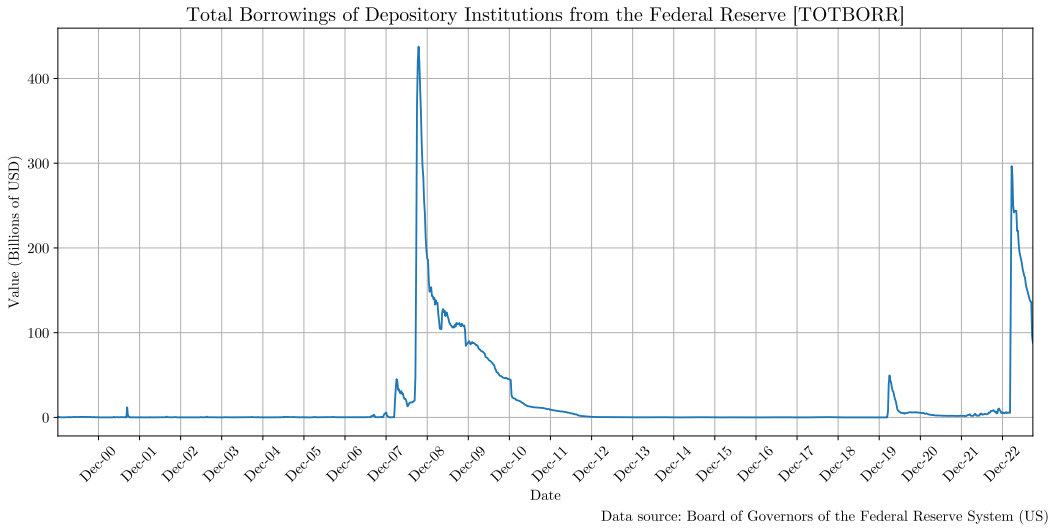

Figure 1.2: Total Borrowings of Depository Institutions from the Federal Reserve (Board of Governors of the Federal Reserve System (US) 2023b)

In the midst of the episode, both market participants and depositors awaited anxiously for the announcements of the regulators regarding the situation and the measures that would be taken. Although the monetary authorities already have a more extensive tool-set and expertise to deal with

[1]It was put into receivership during banking hours, something unusual that shows the severity of the situation. (Pound 2023a)

modern banking stress due to the 2008 financial crisis, the Federal Reserve, the Federal Deposit Insurance Corporation, and the Treasury Department introduced new measures (most of them temporary) to the system. Their European counterparts did the same to contain the fallout of the crisis that affected Credit Suisse.

The different measures had one goal: to prevent the risk of spreading the stress in the system. However, they were valued differently by the depositors and market participants in terms of importance. The effects of this can be seen directly in both deposit flow across institutions and asset classes, and various distinct asset prices in the financial markets.

In this work we aim to achieve a better understanding of the most important actions the regulators can take in order to prevent the contagion of the whole banking system due to specific weaknesses in some financial institutions. In order to achieve this result, our evaluation will consist on the analysis of how the depositors and market participants reacted to such measures in the most recent significant episode of banking stress.

This work is introduced in context with current literature at 2, where the relevant contributions of the this paper, as well as the papers that provide the academic background for this work, are displayed. We start our analysis at 4 by reviewing the data that will be used in the work, as well a preliminary analysis of the scenario. This is followed by 3, that provides a necessary overview of the policy tools used in times of banking stress, as well as their history and past implementations, as well as the development of the narrative of the episode at the same chapter. Chapter 5 combines this with the data and market commentary to evaluate the measures taken, their costs and their results. Results will be summarized at 6, with the conclusion for the work.

2

Literature Review

The failure of Silicon Valley Bank, the second largest bank failure in terms of assets, happened in a moment in time where there was no big stress either in the financial system or in the real economy. There are relevant indicators that the failure was caused by idiosyncratic problems.

SVB failed to hedge properly their asset portfolio, which relied heavily on long-dated MBSs and treasuries, being too heavily exposed to duration risk. When the tightening cycle began, the value of their portfolio fell and they became close to being insolvent (if their assets were marked to market prices). This was exacerbated by the fact that their deposit base was too concentrated on small tech firms from Silicon Valley (with a big presence online) and with deposits well over the insurance limit of 250,000 USD [1].

When SVB failed, it reverberated on the global banking system, exposing weaknesses in other banks and causing the failure or forced acquisition of 3 other financial institutions (Signature Bank and First Republic Bank, failures and in the US, and Credit Suisse, acquisition and in Switzerland). It also prompted regulators to act fast in order to contain the risk that was threatening the banking system as a whole, with both new and revised emergency measures to contain the crisis.

This unusual failure of a relatively big bank in a scenario where there was no significant stress in the real economy or the financial markets has triggered the attention of several researchers, looking to analyse consequences, causes and ways to prevent similar situations in the future.

This work aims to provide policy-makers and market participants with an evaluation of the effectiveness of the tool-set they have at their disposal to deal with specific stress situations in the banking system, once it has already passed the point of regulation and prevention.

This work relies and expands on the work of several authors, with the most prominent ones being Uhlig 2010, Yousaf and Goodell 2023, Yousaf, Riaz, and Goodell 2023, Akhtaruzzaman, Boubaker, and Goodell 2023, Metrick and

[1] According to S&P Global Market Intelligence (Figure 3.3), SVB had almost 94% of uninsured deposits.

Schmelzing 2023 and Metrick and Schmelzing 2021. For the background we used *FDIC's Supervision Of Signature Bank* 2023 and *Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank* 2023, providing context in the background and failure for both Silicon Valley Bank, Silvergate Bank and Signature Bank.

In Metrick and Schmelzing 2021, the authors perform a profound historical analysis of the use of banking system interventions, as well as to provide a definition for 7 broad types of interventions: (1) lending, (2) guarantees, (3) capital injections, (4) asset management, (5) restructuring, (6) rules, and (7) other. The analysis is performed at a large-scale database, built by the authors, that encompasses 1886 interventions happening from 1257 until 2019, and across 138 countries. The paper Metrick and Schmelzing 2023, by the same authors, expands on the previous work with a preliminary narrative of the episode that started with the failure of SVB but they don't analyse the effects of the interventions on such episode.

In Yousaf and Goodell 2023, the authors analyse the effects of the SVB implosion across US equity market sectors, finding significant negative abnormal returns on the date of the failure for some sectors[2], and significant negative abnormal returns after the date of the failure exclusively for financials. Their results indicate that the market believed this was a threat to banking and a negative event as a whole, but not to individual market sectors. Expanding on their previous work, in Yousaf, Riaz, and Goodell 2023 the authors analyse the impact the SVB episode had on various global financial markets. The result is similar to their previous work that was focused on the impact on various US equity sectors: the impact is limited, affecting mostly[3] global banking stocks. An interesting point raised by the papers is that social media could have played a significant role in the bank run, given that it was not anticipated by market participants.

In Akhtaruzzaman, Boubaker, and Goodell 2023, the authors investigate whether there was financial contagion in selected countries[4] due to the failure of SVB. They find that contagion was limited to the global banking industry, which was indeed threatened by the SVB collapse, as is exemplified by the failures/takeovers of Credit Suisse and First Republic Bank. They note that the largest US bank failure since 2008, and the second largest US bank failure

[2]Including financials, materials, and real estate.
[3]The bank run also affected negatively US equities and Bitcoin markets.
[4]G7 countries and Brazil, China, India, and South Africa.

in history, had a limited impact, consistent with effective global regulation following the GFC or effective policy responses after the event.

In this work, we will look to identify and characterize the policy measures taken by regulators in the US and other affected countries in response to the SVB episode. We rely on Metrick and Schmelzing 2021 for the classification of the measures and their historical precedent. Metrick and Schmelzing 2023 provides a good starting point for a timeline and narrative of events.

3

Background

3.1

Emergency Interventions in the Banking System

Originally, the Federal Reserve System was created with the idea of being a "lender of last resort" for the banking system. When a bank would suffer from liquidity – the mismatch of duration between assets and liabilities (mainly short-term or cash deposits) – problems, the Feb would be able to provide adequate funding via the Discount Window facility. (Labonte 2020) The Fed's role as the conductor of monetary policy is more recent.

However, even though the Fed "promotes the stability of the financial system and seeks to minimize and contain systemic risks" and "promotes the stability of the financial system and seeks to minimize and contain systemic risks" (Board of Governors of the Federal Reserve System (US) 2023a), there have been a number of innovations in terms of interventions that the government and private entities can implement in order to safeguard the stability of the financial system.

In this topic we will approach the 3 main types of interventions that can occur in a period of banking distress in order to mitigate or minimize the risks of systemic contagion: lending, guarantee and restructuring interventions. This follows closely the categories defined in Metrick and Schmelzing 2023, although it is not inclusive of all categories and they are more broadly defined.

3.1.1

Lending Interventions

The most common types of banking system interventions are the "lending" interventions. These consist of a government program, implemented by an institution such as a Central Bank, that provides balance sheet liquidity in the form of a loan to a struggling financial institution. (Metrick and Schmelzing 2023)

The lending interventions can be broad-based, such as program that provides funding for institutions that accept deposits (banks) or other types of financial institutions, or ad hoc, to a specific financial institution. (Metrick and Schmelzing 2023)

Although this is generally not thought of as an emergency intervention, the discount window would be included as a (permanent) broad-based lending program that can provide liquidity to banks. However, there is evidence of stigma associated with utilizing the DW facility, with banks preferring to use alternatives, even if they are more costly. (Armantier et al. 2015) Changes to the accepted collateral of DW borrowing due to financial instability are characterized as emergency lending interventions (Metrick and Schmelzing 2023).

A recent example of a broad-based lending intervention is the "Bank Term Funding Program", implemented by the Fed in the 2023 banking crisis. The program *"offers loans of up to one year in length to banks, savings associations, credit unions, and other eligible depository institutions pledging U.S. Treasuries, agency debt and mortgage-backed securities, and other qualifying assets as collateral. These assets will be valued at par."* (The Federal Reserve Bank (US) 2023) With this, all institutions that are eligible for the DW facility can access another line of credit with less associated insolvency stigma and with the possibility to post collaterals at par, and that seems to been the preferred facility for banks after the peak of the recent crisis. (Wallerstein 2023)

A recent example of an ad hoc lending intervention can be found at the UBS's takeover of Credit Suisse, in Europe. In order to be able to successfully absorb the struggling counterpart, the Swiss National Bank offered substantial liquidity to both UBS and CS individually. (The Swiss National Bank 2023c)

3.1.2

Guarantee Interventions

Deposit insurance has played a key role during several banking crises in history in maintaining consumer confidence and preventing the spread of financial/liquidity troubles amongst the financial system. (Chappell 2023) Effectively all countries with a functional banking system will have some type of deposit insurance. (International Association of Deposit Insurers 2023)

Arda and Dobler 2022 define the general pourpose of the deposit insurance/guarantee scheme in the following manner:

> By protecting retail and other small depositors in a bank failure, deposit insurance minimizes the risk of deposit runs and mitigates contagion risk. If depositors trust a DIS [deposit insurance system], they are less likely to run on a bank and exacerbate liquidity stress, which would undermine recovery or resolution measures. If depositors lose confidence, as happened in some banks during the 2008–09 global financial crisis (GFC)—such as in Iceland, the Netherlands, United Kingdom, and the United States, runs can lead to contagion and banking sector instability. (Arda and Dobler 2022)

The most common type of guarantee intervention is the extension of deposit insurance in some way. Amplifying existing deposit guarantees, for example, makes depositors that were previously uninsured more comfortable with their situation and thus less motivated to withdrawal their deposits. (Metrick and Schmelzing 2023) This is typically a government (or quasi-government[1]) initiative that is implemented in order to stabilize deposit flow in the financial system.

Other types of guarantee interventions exist, although less common. They can span across other bank liabilities *ex-deposits*, across certain assets of the financial institution or both.

These interventions can be broad-based, for example guaranteeing deposits over the current insured limit for all banks during a certain time frame, or ad hoc, guaranteeing deposits of a single (or a small subset) financial institution for a certain period.

A recent example of an ad hoc guarantee intervention can be found at the 2023 banking episode, when the FDIC, the Deparment of the Treasury and the Fed decided to use a "systemic risk exception" to increase the deposit insurance limit on SVB and Signature Bank deposits:

> [...] Secretary Yellen approved actions enabling the FDIC to complete its resolution of Silicon Valley Bank, Santa Clara, California,

[1] If it is done by a quasi-government organization, such as The Federal Deposit Insurance Corporation, in the US.

> in a manner that fully protects all depositors. Depositors will have access to all of their money starting Monday, March 13. No losses associated with the resolution of Silicon Valley Bank will be borne by the taxpayer.
>
> We are also announcing a similar systemic risk exception for Signature Bank, New York, New York, which was closed today by its state chartering authority. All depositors of this institution will be made whole. [...] (The Federal Deposit Insurance Corporation 2023)

3.1.3

Restructuring Interventions

Restructuring interventions are interventions mandated by authorities that restructure the balance sheet of the financial institution as a whole (Metrick and Schmelzing 2023). This is more common on the later stages of financial distress, after other types of intervention have – or would have, if implement at that stage – failed.

Metrick and Schmelzing 2023 define two main types of restructuring interventions: Restructuring or resolution; and Stakeholder bail-in.

At the first, there is mandatory *"restructuring, resolution, or liquidation process for one or more troubled financial institutions"*, dealing with both the assets and liabilities of the bank. This could mean, for example, a mandatory takeover of a bank or to place a bank under receivership.

At the second, there is financial loss absorbed by some stakeholder(s) at the bank. This could mean the write-off of certain bonds or bond-like liabilities, or the conversion of certain liabilities to equity.

Both were present at the 2023 banking episode, the first when Credit Suisse was aquired by UBS and the second when unsecured/AT1 bonds[2] of Credit Suisse were written down to zero in that same deal. (Metrick and Schmelzing 2023)

[2]Adittional Tier 1 capital instruments, also known as contingent convertible bonds (CoCo's), are instruments that can be converted to equity or written-off in certain specific scenarios. Usually, but not exclusively, the write-off trigger is related to the capital ratio of the bank that issued the instrument. (Kiderlin 2023)

3.1.4

Other Interventions

Other interventions defined in Metrick and Schmelzing 2023 are: asset management; capital injections; rules; and others.

Asset management interventions consist of authorities transferring part or all assets of financial institutions (can be broad-based or *ad hoc*) to a designated vehicle or to another institution. Capital injections involve authorities assuming ownership of financial institutions either via equity or debt purchases. Rules interventions range from declaring bank holidays or similar to implementing a a partial or general debt moratoria amongst financial institutions. One intervention that is not encompassed by the previous ones is a major communication event by a relevant authority[3] (Metrick and Schmelzing 2023).

3.2

Context of the 2023 banking stress episode

3.2.1

SVB

Prior to the crisis, SVB was considered one of the best regional banks in the US (Le 2023). The bank focused on providing services for the technology and life sciences sector companies and their executives/founders. There was also a focus on acquiring early-stage companies as customers and retaining them through their growth as a company. (*Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank* 2023)

Even though SVB was founded in 1983, most of its growth happened between 2019 and 2021. Assets grew 198% and deposits grew 204%. The bank attributed this rise in deposits to the growth in liquidity of their clients, obtained by liquidity events in public or private markets. This was somewhat facilitated by the low interest environment that lasted through this period.

[3] An event that causes *"significant changes in market expectations or the de facto assessment of the health or profitability of the banking or financial sector"* (Metrick and Schmelzing 2023)

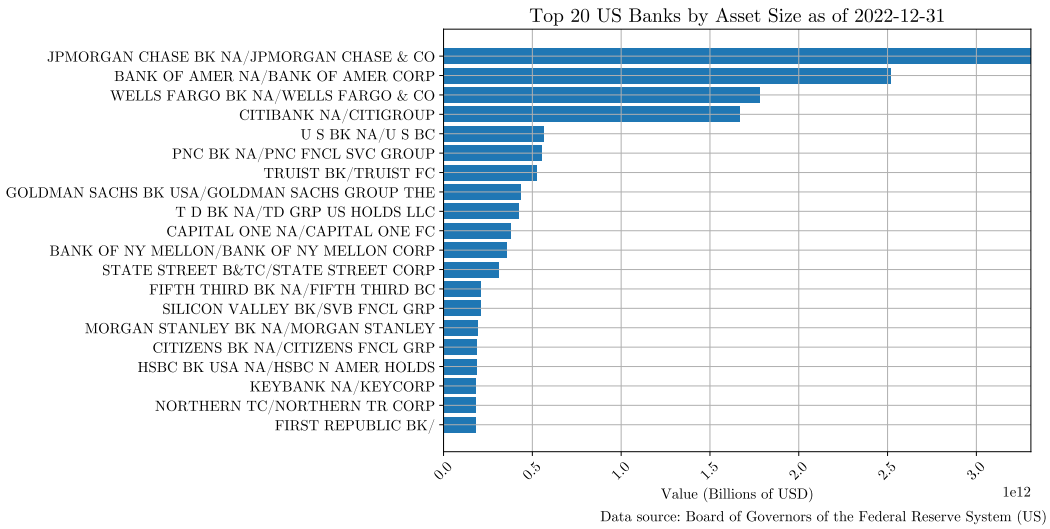

Figure 3.1: Largest Commercial Banks in the US by Assets, at Dec/21

(*Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank* 2023)

At the end of 2021 it was the 14th largest US commercial bank by assets. In 2022 asset growth was almost non-existent due to a slowdown in deal activity in the technology sector, mostly because of higher interest rates. (*Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank* 2023) The bank ended 2022 as the 16th largest US commercial bank, with $209 billion in assets and $175 billion in deposits.

The expressive growth in deposits from 2019 to 2021 was not entirely directed towards lending. Most of those deposits were invested in long-term investment securities, mostly government treasuries and Agency MBS. Investments in debt securities accounted for 60% of SVB's assets in the end of 2021, almost double the value of loans and leases (31.8%).

These investments in debt securities, although "safe" from a credit risk perspective, were certainly not immune from interest rate risk[4]. While the bank believed it was doing good investments, they were investing in medium to long term securities yielding rates that were in historically low levels.

Initially this does not need to be a problem, since the banks in the US can hold a part of their portfolio in a "held to maturity" (HTM) book, that does not need to be marked-to-market. The securities in this portfolio are not to intended to be sold or traded before they mature. Only securities in

[4]Interest rate risk is the risk of the fluctuation in the price of a bond due to changes in market interest rates (Ross, Westerfield, and Jordan 2010)

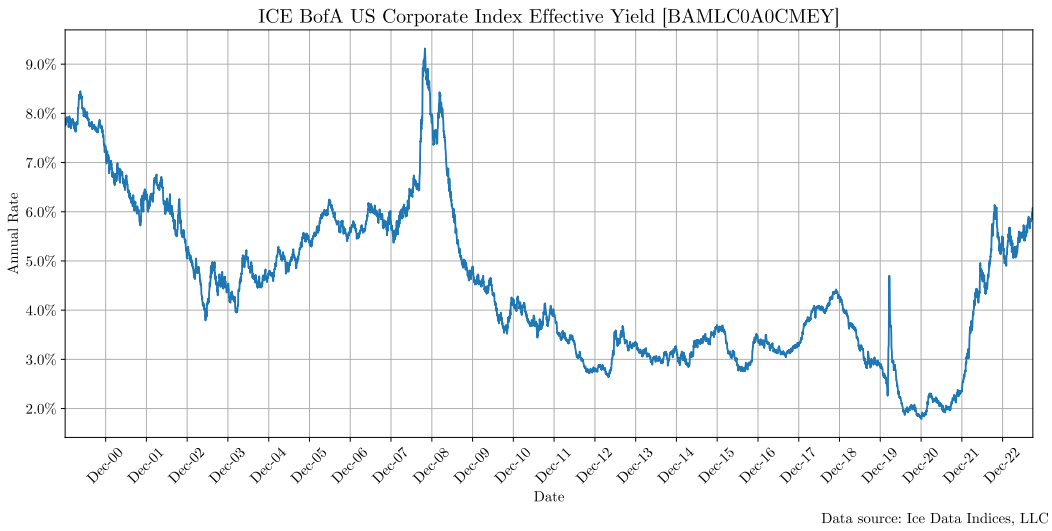

Figure 3.2: US Corporate Bond Yield since 2009. (Ice Data Indices, LLC 2023)

the "available for sale" (AFS) book are marked-to-market. Generally, if the bank needs to sell a security from their HTM book, the entire book would be marked-to-market.

Given that the bank does not run into liquidity issues, this structure provides a buffer of accounting protection for the bank's book value of equity, since not all investment securities in their portfolio need to be marked-to-market and thus are not subject to changes in value due to different market conditions. Usually banks hold a more sizeable allocation to securities on the HTM book than the AFS book. If the bank runs into liquidity issues and is forced to sell securities in the HTM book, it could generate unease at depositors and also reduce equity capital substantially.

According to FDIC data, in the end of 2022 SVB had a "held to maturity" book of $91 billion and an "available for sale" book of $26 billion.

This was a problem in the asset side of the balance sheet. Looking at the liabilities side, we find that the bank was exposed to a big concentration risk on its clients, as well as a risk of having a deposit base that was largely not FDIC insured.

According to S&P Global Market Intelligence, SVB had almost 94% of uninsured deposits. This is a source of vulnerability in case of stress. Because depositors are largely not protected, they have an incentive to withdrawal their money when there are times of relative stress. This can lead to bank a run, if the stress is not controlled quickly enough.

Top US banks by proportion of uninsured deposits

Limited to US banks with at least $50 billion in assets at Dec. 31, 2022

Ranked by call report data

Company (top-level ticker)	Total assets ($B)	Uninsured deposits[1] — Call report data before exclusions, public filings data ($B)	Uninsured deposits[1] — Call report data before exclusions, public filings data — Proportion of total deposits after exclusions (%)[2]	Preferred deposits ($B)[3]	Loans + HTM securities/ total deposits (%)[4]	AOCI ($B)	AOCI — Proportion of total capital (%)	Tangible equity ratio (%)
● Silicon Valley Bank	209.0	151.6	93.8	0.0	94.4	-1.9	10.6	7.27
Bank of New York Mellon (BK)	324.6	175.1 / 156.6	92.0 / 82.3	0.7	31.2	-4.4	21.5	6.24
State Street Bank and Trust Co. (STT)	298.0	148.9	91.2	0.0	40.1	-3.4	18.1	6.16
● Signature Bank	110.4	79.5	89.3	1.4	93.3	-2.0	18.1	7.26
Northern Trust Co. (NTRS)	154.5	41.9	81.6	0.0	54.5	-1.5	13.0	6.62
Citibank NA (C)	1,766.8	598.2	73.7	2.0	64.6	-29.9	18.1	8.62
CIBC Bank USA (CM)	50.9	30.0	73.1	0.1	87.1	-0.3	4.5	11.19
HSBC Bank USA NA (HSBA)	162.4	94.2 / 86.9	70.6 / 65.2	0.1	47.4	-2.6	12.8	9.52
City National Bank (RY)	96.5	53.1	70.3	0.3	93.6	-1.6	17.3	6.65
First Republic Bank (FRC)	212.6	119.5	67.4	0.6	110.6	-0.3	1.7	8.11
East West Bank (EWBC)	64.1	35.1 / 26.8	65.8 / 50.2	3.9	91.1	-0.8	11.3	8.52
BMO Harris Bank NA (BMO)[5]	177.0	88.6	60.5	3.0	72.7	-3.5	16.9	8.87
Comerica Bank (CMA)	85.5	45.5	60.4	0.1	72.8	-3.7	40.7	4.85
Western Alliance Bank (WAL)	67.7	31.1 / 29.5	56.3 / 53.4	0.4	101.7	-0.7	10.6	7.52
Frost Bank (CFR)	53.0	23.8	53.6	1.5	44.6	-1.3	33.5	4.60
Banco Popular de Puerto Rico (BPOP)	56.1	28.1	53.1	16.2	58.3	-2.4	52.4	3.02
● MUFG Union Bank NA (USB)[6]	104.4	43.7	53.0	3.5	70.5	0.0	0.4	10.29
Zions Bancorp. NA (ZION)	89.5	37.6	52.2	1.7	93.2	-3.1	38.5	4.33
JPMorgan Chase Bank NA (JPM)	3,201.9	1,057.9	52.0	43.6	64.3	-18.0	6.2	8.32
U.S. Bank NA (USB)[6]	585.1	234.3	51.4	9.0	90.6	-11.2	19.7	5.81
Synovus Bank (SNV)	59.6	25.1	50.7	6.5	89.3	-1.4	23.5	6.74
● Bank of the West (BMO)[5]	91.6	36.6	50.7	6.3	83.4	-2.9	33.8	5.73
KeyBank NA (KEY)	187.6	75.6 / 67.1	50.0 / 44.4	8.0	88.7	-6.0	30.2	5.66
Fifth Third Bank NA (FITB)	206.3	88.3 / 69.4	48.4 / 38.0	6.6	72.3	-5.1	23.8	7.20
Goldman Sachs Bank USA (GS)	487.0	168.0 / 128.7	47.6 / 36.5	0.0	46.5	-1.2	2.2	9.57
Citizens Bank NA (CFG)	226.4	88.9	47.5	9.6	91.6	-4.5	19.3	7.10
Manufacturers and Traders Trust Co. (MTB)	200.3	79.4 / 74.2	47.1 / 44.0	11.4	87.4	-0.8	4.1	8.21
First Horizon Bank (FHN)[7]	78.7	30.3	46.2	5.1	92.6	-1.4	15.9	8.35
Bank of America NA (BAC)	2,418.5	909.3 / 617.6	46.1 / 31.3	25.2	82.0	-18.4	9.5	7.10
Huntington National Bank (HBAN)	182.3	84.6 / 47.3	45.6 / 25.5	4.1	90.8	-3.1	17.5	6.46

● Acquired, failed companies

Data compiled Mar. 13, 2023.
AOCI = accumulated other comprehensive income; HTM = held-to-maturity securities shown at cost basis.
Tangible equity ratio = tangible equity divided by tangible assets.
Analysis includes U.S. commercial banks, savings banks, and savings and loan associations that reported at least $50 billion in total assets at Dec. 31, 2022. Foreign banking organizations are excluded.
[1] Uninsured deposits are the bank's estimated value of deposits held in domestic U.S. offices not covered by federal deposit insurance, as reported in call report filings at the subsidiary level. Data may include internal company deposits, collateralized deposits that are backed with securities, and other deposits structured to qualify for insurance or other collateralization and may be higher, sometimes significantly so, from GAAP filings at the parent-company level. GAAP data is sourced from parent-company public filings for the year ended Dec. 31, 2022, and may exclude items such as intercompany deposits and municipal deposits backed with pledged securities; however, disclosures vary. GAAP data is collected on a best-efforts basis and is shown where it is materially different from subsidiary level data reported in call report filings. Not all companies had enough granular data in GAAP filings to make adjustments.
[2] Total deposits are calculated as total deposit liabilities before exclusions minus total allowable exclusions as reported in Schedule RC-O in in call report filings at the subsidiary level.
[3] All deposits of states and political subdivisions in the U.S., including transaction and nontransaction accounts, which are secured or collateralized as required under state law.
[4] Total loans and leases, including held-for-investment and held-for-sale, plus held-to-maturity securities shown at cost basis divided by total deposits, including foreign and domestic deposits.
[5] BMO Harris Bank NA acquired Bank of the West on Feb. 1, 2023.
[6] U.S. Bancorp, parent company of U.S. Bank NA, acquired MUFG Union Bank NA on Dec. 1, 2022, but maintained a separate call report filing for MUFG Union Bank NA for the quarter ended Dec. 31, 2022.
[7] Merger target.
Data based on regulatory call report filings as of Dec. 31, 2022, unless otherwise noted.
Top-level tickers are for the ultimate parent company's home-country stock exchange.
Source: S&P Global Market Intelligence.

Figure 3.3: Top banks by uninsured deposits as of 31/12/22.

In 2022 the tech sector suffered from a slowdown in deal flow, liquidity events and venture capital inflows due to the rising interest rate environment. This slowed deposit inflows from SVB's client base, while there were running deposit outflows due the clients needs to fund their own business operations (since most early-stage life-sciences and technology companies are cash burning). SVB's deposits shrank 8% from the end of 2021 to the end of 2022, and all indicated that this was continuing into 2023. (*Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank* 2023)

On March 8, 2023 SVB announced it had sold "substantially all" of their AFS portfolio, totalling $21 billion and realizing an investment loss of $1.8 billion, and that it planned to raise $2.25 billion of equity capital in a public offering. (Becker 2023) It also alerted to the following problems the bank was facing:

> "client cash burn has remained elevated and increased further in February, resulting in lower deposits than forecasted. The related shift in our funding mix to more, higher-cost deposits and short-term borrowings, coupled with higher interest rates, continues to pressure NII and NIM." (Becker 2023)

This, alongside the wind-down of operations from Silvergate Bank, contributed to worsen greatly depositor sentiment. Depositors interpreted this as a sign of financial distress and started to withdrawal money as soon as they could, on March 9. At that day, as of the end of banking hours, SVB had lost some $40 billion of deposits, and expected to lose another $100 billion on March 10.

Upon conducting an investigation amongst the SVB episode, the *Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank* 2023 found that: *"This run on deposits at SVB appears to have been fueled by social media and SVB's concentrated network of venture capital investors and technology firms that withdrew their deposits in a coordinated manner with unprecedented speed."*

In the morning of the 10th of March, upon seeing that the bank had no means of providing enough funds to cover all incoming withdrawals, the California financial regulator closed SVB and put it into receivership.

3.2.2

Signature Bank of New York

Signature was a New York based bank that failed and was shut down by regulators in the aftermath of SVB's failure, on March 12, 2023. At the end of 2022, it ranked the 30th biggest bank in the US by assets, with $118 billion in assets.

The bank was an early mover in the digital asset banking initiative, and part of its business focus was catering to clients related to crypto. Almost one third of all deposits were related to digital initiatives in the end of 2021, according to the company, and many considered SBNY to be the "banker to the crypto world".

According to *FDIC's Supervision Of Signature Bank* 2023, two main causes of the failure – apart from the contagion caused by the failure of SVB and voluntary liquidation of Silvergate – were its over-reliance on uninsured deposits without appropriate liquidity management and their failure to understand the risk of its concentration in the crypto industry.

SBNY failed to manage their uninsured deposits in an efficient way, upon experiencing some deposit outflows in 2022, in part due to a harsher environment for crypto. With lower deposits, the bank reduced their investments in liquid assets and started to rely more on other assets that yielded more and were less liquid. At the end of 2022, investments in cash equivalents and Treasuries or Agency MBS represented about 34% of all deposits, at the same time that uninsured deposits accounted for 90% of deposits. Another source of problems was that the loans it made were mostly not qualified to serve as collateral in the DW lending facility, further reducing the means of obtaining liquidity in times of stress. (*FDIC's Supervision Of Signature Bank* 2023)

When SVB was shut down by regulators in the morning of March 10, 2023 – a friday –, SBNY started to see significant outflows on their deposits, which at the end of the day accounted for 20% of total deposits. According to the *FDIC's Supervision Of Signature Bank* 2023: *"Outgoing wire requests significantly exceeded funds available in SBNY's Federal Reserve account."*. There was an attempt to access DW lending facilities but it was done too late in the business day and was unsuccessful. In the weekend, deposit withdrawal requests were accumulating rapidly and, on March 12, 2023, upon seeing $7.9 billion in pending outgoing wires for the next day and only $3 billion

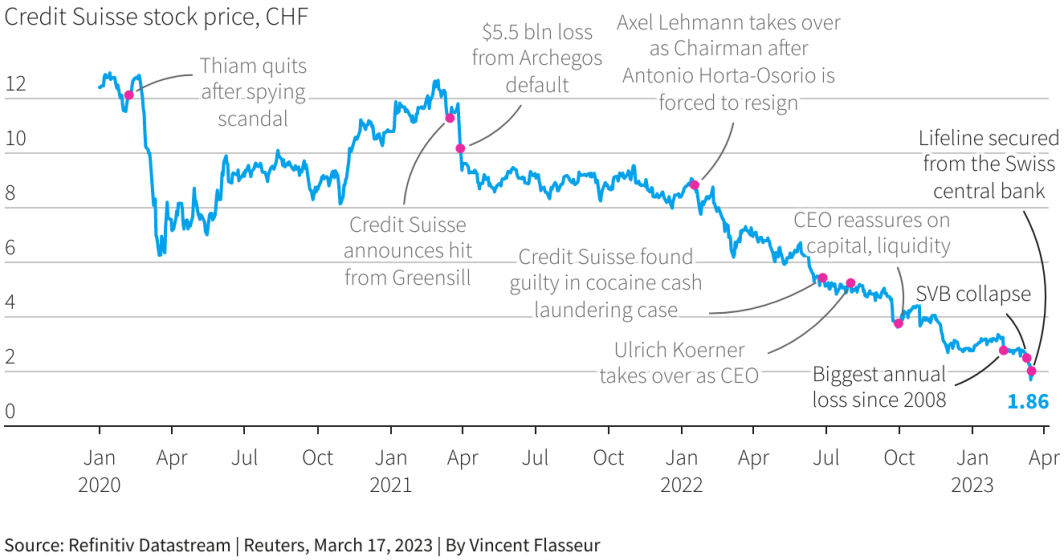

Figure 3.4: Credit Suisse stock price since 2020, with commentary

in liquidity, the NY financial regulator shut down Signature and put it into receivership.

3.2.3

Credit Suisse

Credit Suisse was a globally systematically important bank that operated several business lines, from high net worth banking to asset management. It was the second biggest bank in Switzerland, following rival UBS, and had a significant presence in Europe. (Daga 2023)

Since 2020, the bank has gone through numerous scandals, leadership changes and accounting losses. In 2022, it suffered the biggest annual loss since the GFC, of 7.29 billion Swiss francs, and clients had withdrawn collectively $119 billion in the 4^{th} quarter of the year.

In 2023 the bank was attempting to implement a turnaround plan, in order to reduce losses and become more sustainable for the long run. However, the events that took place in March 8 and the following days had severe impacts on the bank. (McCabe and Mitchell 2023)

After the collapse of SVB and Signature, investors were selling off bank stocks as a whole in fear of what could be the next affected entities. CS, with a troubled recent history, became the next cause for worry in investors

and depositors, reducing their confidence in the bank. (McCabe and Mitchell 2023)

In the week after the events in the US, CS's stock went down by 31%[5] and their CDS[6] surged, indicating that a default event was more likely. On Wednesday, March 15, CS's largest shareholder, Saudi National Bank, announced it would not add to its holdings due to regulatory requirements[7]. This contributed to the unease of depositors and investors. In that week, the WSJ estimated that CS *"faced as much as $10 billion in customer outflows a day"*. (McCabe and Mitchell 2023)

On the of March 16, CS announced that it would borrow $53.7 billion from the Swiss National Bank (Switzerland's Central Bank) in order to preemptively strengthen liquidity. This was not enough to calm investors, with CDS ending the week on extremely high levels and European bank stocks falling significantly on Friday. (McCabe and Mitchell 2023)

Over the weekend, Swiss regulators engineered a deal for UBS to acquire Credit Suisse without shareholder approval of either party, in order to safeguard the stability of the banking industry. It was the largest merger between two global systematically important banks since the GFC. (McCabe and Mitchell 2023)

3.2.4

First Republic Bank

FRC was a regional bank based in San Francisco that focused on catering to high net worth clients. It essentially faced the same problems as SVB: it had a high exposure to uninsured deposits[8]; and a portfolio of securities and loans that had yields in historically low levels. (Ensign 2023)

[5] From March 8th to March 16th.

[6] *"A credit default swap (CDS) is a financial derivative that allows an investor to swap or offset their credit risk with that of another investor. To swap the risk of default, the lender buys a CDS from another investor who agrees to reimburse them if the borrower defaults. (Hayes 2023)"*

[7] Usually banks cannot own more than than 10% of other banks due to regulatory requirements, and Saudi National Bank already owned 9.9% of CS.

[8] Accoding to S&P Market Intelligence, as of the end of 2022, 67% of its deposits were uninsured.

When the Fed started raising interest rates, the bank saw the value – on a mark-to-market basis – of their assets drop and their cost of funding[9] rise, given more attractive (higher yielding) alternatives for depositors, such as money market funds. This put the bank in a difficult position, suffering from some deposit outflows since before the crisis. (Ensign 2023)

When the crisis erupted, depositors started withdrawing their money and the bank became distressed. In the month of March, it lost over $100 billion dollars in deposits (from a total of $176.4 billion on the end of 2022). According to Ensign 2023: *"the run cost First Republic all but $19.8 billion of its uninsured deposits"*.

Given the heightened risk of financial contagion in the first weeks of the crisis, on the 16th of March several large US banks injected $30 billion in uninsured deposits into the bank, hoping to ease depositor concerns and reduce the overall risk of the situation. The bank continued its operations until it was put into receivership and subsequently sold to JP Morgan, on the 1st of May, marking the end of the crisis.

[9] According to Kagan 2023: *"The term 'cost of funds' refers to how much banks and financial institutions spend in order to acquire money to lend to their customers. [...] For lenders, such as banks and credit unions, the cost of funds is determined by the interest rate paid to depositors on financial products, including savings accounts and time deposits."*

4

Data and Methodology

This paper will utilize different datasets for different purposes. We will rely on Metrick and Schmelzing 2021 for the historical implementations of the emergency policy measures on banking crisis episodes. In order to analyse the effects of the policy measures undertaken in the SVB episode, we will utilize both qualitative and quantitative sources of data.

For the qualitative data we will utilize the communication of market participants, represented in this work by the research and sales/trading areas of relevant US investment banks: JP Morgan and Goldman Sachs.

The quantitative data is comprised of historical quotes (daily and intra-day) of a number of financial assets and indices, as well as macro-economic and monetary data. Data sources used for the majority of series are Bloomberg Finance L.P., Federal Reserve Bank of St. Louis (via FRED) and the Federal Deposit Insurance Corporation. Notable series:

- US yield curve data (maturities: 3 months up to 2 years)
- Financial Select Sector SPDR Fund: XLF US Equity (US equity financial sector ETF)
- SPDR S&P Regional Banking ETF: KRE US Equity (US equity regional banking sector ETF)
- S&P 500 Total Return Index: SPXT Index (US broad equity market index)
- Total Borrowings of Depository Institutions from the Federal Reserve
- Total Borrowings from the Discount Window
- Deposits, Large Domestically Chartered Commercial Banks
- Deposits, Small Domestically Chartered Commercial Banks

This work will follow a narrative approach and analysis of the episode and respective measures. We will analyse the impact of the various policy reaction on market prices of assets, on the behaviour of financial institutions and depositors, as well as on several market participants.

4.1

Preliminary Analysis of Data

The period we will use to analyse the datasets presented ranges from the 8th of March, 2023 – the day that SVB publicly announced it was in financial trouble – to the 1st of May, 2023 – when First Republic Bank was sold to JPMorgan. We will most of our attention on the week of SVB's and SBNY's failures and the next, with the sale of Credit Suisse.

Setting the 8th of March as the initial value in our analysis, we can see that most of the impact of the banking crisis in the US stock markets manifested on the Financials and Regional Banking sectors – represented by the XLF and KRE ETFs, respectively –, with the S&P 500 returning to its pre-crisis value at around 1 week after the beginning of the crisis.

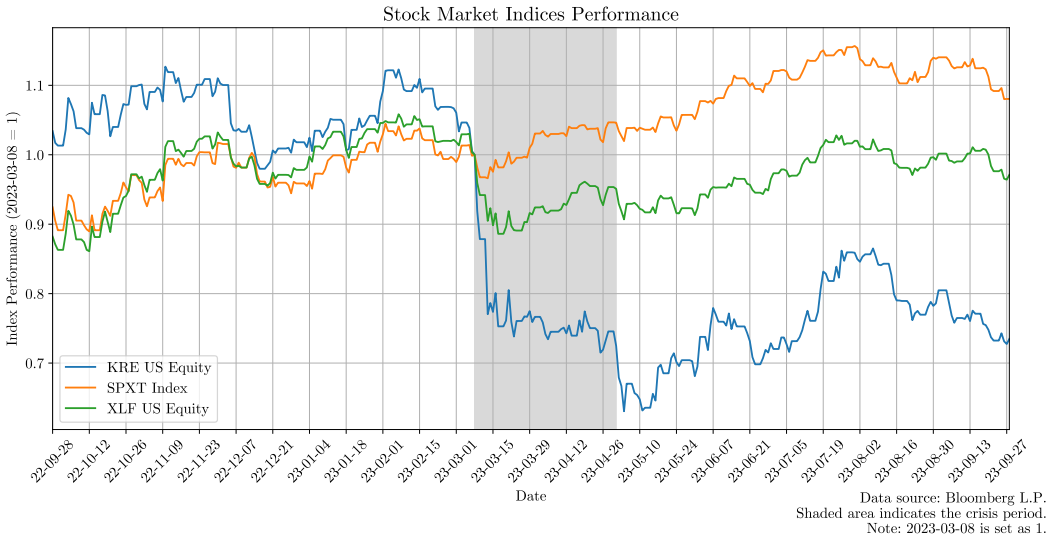

Figure 4.1: Stock market indices performances around the crisis period.

We can also see a severe impact on yield curve in the period, especially around the shorter term rates. The fall of the short-end of the curve indicates that market participants believed that the financial stress could lead to some easing of policy by the Federal Reserve. In the 1 year maturity, we see a difference of more than 1 percentage point from the 8th of March to 1 week later.

Looking at the Federal Reserve lending data also provides us with a clearer view of the stress incurred in the banks. Discount Window lending – the sum of Primary, Secondary, and Seasonal Credit – jumped from very low levels to around 150 billion USD in the first data point after the crisis. Other

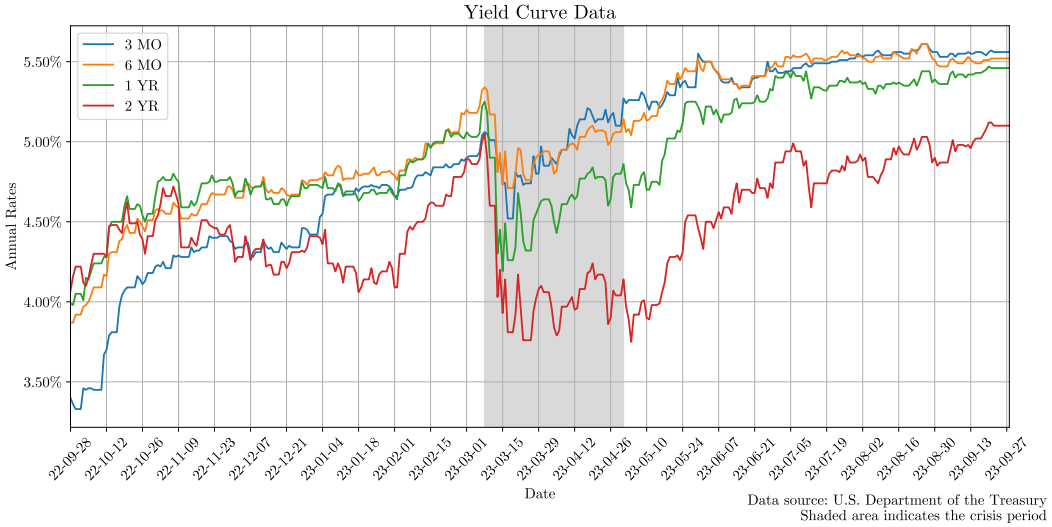

Figure 4.2: Yield Curve data around the crisis period.

credit extensions, which include loans that were made available to depository institutions established by the FDIC, also jumped to around that same level.

After the BTFP was announced, it gained traction given its advantages in terms of collateral and repayment conditions. All those considered, the Fed stepped in to provide almost 350 billion USD in the first week of the crisis. This balance has been going down steadily since then.

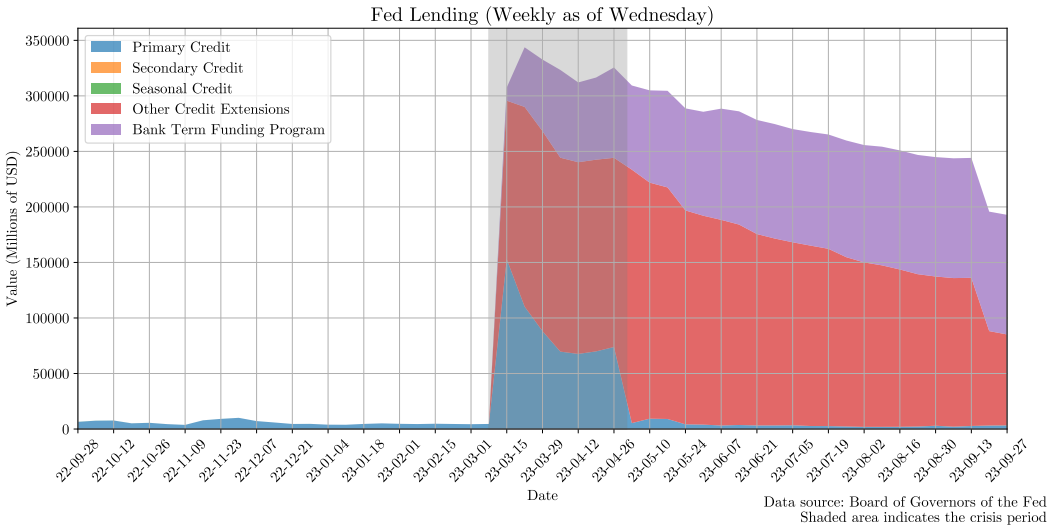

Figure 4.3: Fed lending data around the crisis period.

We can also see the impact of the stress regarding consumer confidence in banks in the datasets for Deposits on Domestically Chartered Commercial Banks. Deposits on large domestic banks were slowly declining prior to the crisis mostly because money market alternatives were more attractive since

short term rates were no longer very close to zero. This was less pronounced on small domestic banks because their deposits are usually higher earning.

However, when the crisis erupted there were big outflows of deposits from the smaller banks (going both to money market alternatives and large banks) due to a loss in confidence in those institutions. After stability measures were announced, outflows stabilized and deposits are growing slowly back to their initial point before the crisis.

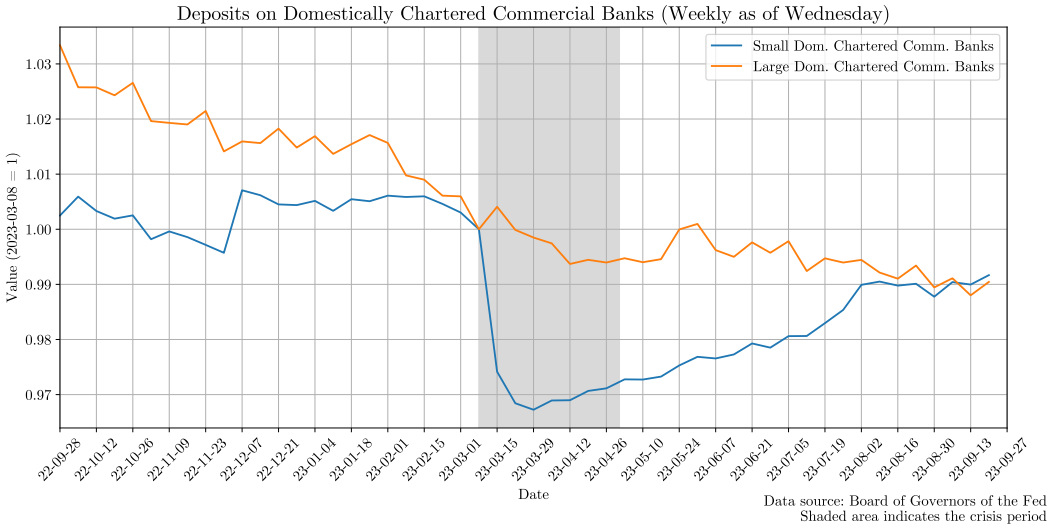

Figure 4.4: Bank deposit data around the crisis period.

5

Analysis of the Interventions in the 2023 banking crisis

Date	Measure	Type
10/09/23	Janet Yellen expressed full confidence in the banking system.	Soft / Communication Event
12/03/23	Full deposit insurance for SVB and SBNY by the FDIC	Hard / Guarantee (Account guarantee)
12/03/23	Bank Term Funding Program (BTFP)	Hard / Lending (Broad-based emergency lending)
12/03/23	Pres. Biden announced the US banking system was safe.	Soft / Communication Event
15/03/23	SNB announced liquidity lines for CS	Hard / Lending (Ad hoc emergency lending)
16/03/23	Large banks pledge First Republic $30 billion in deposits	Hard / Capital injection (Ad hoc)
19/03/23	Credit Suisse acquisition and restructuring	Hard / Restructuring, Guarantee, Lending
01/05/23	First Republic was taken over by the FDIC and sold to JPM.	Hard / Restructuring

Table 5.1: Major interventions on the 2023 banking crisis.

The first two hard interventions that in the 2023 banking crisis were announced in the weekend, on Sunday the 12^{th} of March. This gave market participants time to analyse the key points and reflect on their major concerns. The Federal Reserve indicated systemic risk in the reasons for both the account guarantee of the two failed banks and for the newly created Bank Term Funding Program (BTFP), a broad-based emergency lending program.

Market participants were not certain of the level of risk the situation entailed, but were conscious that, if no action was effectively taken/announced by the regulators, the level of systemic risk would be much greater. Commentary from Caprihan and Dyatlov 2023 is consistent with this:

> "we are fortunate that the Monday mayhem has been avoided, but the question remains whether the broader, structural issue has been fixed [...] [The two interventions] sends a signal, provides liquidity, but will uninsured, large depositors at small regional banks remain due to the announcement of SIVB and SBNY, or was the angst over the last 48hrs enough that money would move to the larger regional and GSIBs?"

[1] As of 05/11/23. Prior estimate from the FDIC was $19.2 billion at 04/11/23.

[2] Deposit Insurance Fund balance in the end of Q1 2023 was $116.071 billion.

[3] Deposits at Small Domestically Chartered Commercial Banks were $5324.54 billions, as of 03/08/2023.

		Equity Indexes			Yield Curve Rates			
		KRE US	**SPXT**	**XLF US**	**3 MO**	**6 MO**	**1 YR**	**2 YR**
10/03/23	Change	-4.39%	-1.44%	-1.82%	-4 bps	-15 bps	-28 bps	-30 bps
	Value	49.37	8253.65	32.48	5.01%	5.17%	4.90%	4.60%
13/03/23	Change	-12.31%	-0.15%	-3.95%	-14 bps	-36 bps	-60 bps	-57 bps
	Value	43.29	8241.39	31.19	4.87%	4.81%	4.30%	4.03%

Table 5.2: Equity and Fixed Income markets after the SVB event.

Intervention	**Full deposit insurance for SVB and SBNY by the FDIC**
Date	12/03/2023
Type	Hard / Account guarantee.
Overview	The FDIC will insure all deposits in SVB and SBNY, including those over the $250,000 limit, using a systemic risk exception.
Objective	Shore up depositor confidence in the banking system (although being short of a system-wide guarantee) and slow down deposit outflows from smaller/weaker banks.
Size/cost of intervention	Estimated at $15.8 billion[1]. Represents: 13.6% of the DIF balance in the end of Q1 2023[2] and 0.297% of all deposits in small US commercial banks[3].
Market movement	Negative: S&P 500 -0.15%; Regional Banks -12.31%; Financial Sector -3.95%. (Values for 13/03/2023)
Market commentary	Very positive (usually referenced together with the new liquidity facilities for banks).

The 2 hard interventions announced on Sunday were positively received by market participants, given the collected commentary, even though equity and treasury markets suffered losses. As we can see on 5.2, after the weekend announcements of interventions, there were continued drawdowns both on equities (albeit much more concentrated on the regional banking sector, represented by the KRE US, than the broader market, represented by the S&P500/SPXT) – maybe and indication of less systemic risk than previously perceived) and treasuries, with shorter term rates decreasing from 14 to 60 basis points[5]. The sharp decrease in rates indicates that the market believed the Fed would need to ease policy in order to avoid more pressure to the banking system.

As observed in 4.4, the majority of the outflows in deposits in small banks occurred in the first 4 business days of the crisis, as observed by the 15^{th} of March observation of a more than 2.5% drop in deposits. This data is released on the same day as 4.3, that also shows that most of the borrowing from the Fed – on the BTFP or DW[6] programs – was made on that same period. After this first release, both deposits outflows and lending by the Fed saw a

[4]The maximum value of lending made via the BTFP was $108 billion on 09/20/23, after the peak crisis period.

[5]1 basis point (bp) equals $1/100^{\text{th}}$ of 1% or 0.01%.

[6]Its important to note that initially most of the borrowing was made via the Discount Window, since banks have a wider array of collateral they can use there (even though they are valued at market prices, and not at par).

Intervention	**Bank Term Funding Program (BTFP)**
Date	12/03/2023
Type	Hard / Broad-based emergency lending.
Overview	New liquidity facility for banks by the Fed. Similar to the Discount Window but the loans are made against collateral valued at par. There are more restrictions on what assets can be used as collateral than in the DW.
Objective	Provide liquidity for banks with larger MTM losses on their asset portfolio and are suffering from outflows.
Size/cost of intervention	$11.9 billion (0.23% of all deposits of small US commercial banks) of lending in the first week, going up to $75.8 billion (1.463% of all deposits of small US commercial banks) at the 3rd of May, 2023.[4]
Market movement	Negative: S&P 500 -0.15%; Regional Banks -12.31%; Financial Sector -3.95%. (Values for 13/03/2023)
Market commentary	Positive (usually referenced together with the deposit guarantees).

small increase followed by a steady incremental reversal. This also indicates the initial policy measures were well received by both the public and financial institutions.

> "The big question is whether the FDIC and Fed make the uninsured depositors whole—or at least close to whole," said Bob Elliott, co-founder and chief investment officer of the asset manager Unlimited. "If the resolution of SVB Financial isn't handled well, there's a systemic risk that uninsured depositors will flee small banks." (Wallerstein, Grossman, and Zuckerman 2023)

> [BTFP] will eliminate an institution's "need to quickly sell those securities in times of stress" and would be enough to cover all uninsured US deposits, the Fed said. (Smith et al. 2023)

We classify the full insurance of deposits at the 2 failed banks as a very effective measure. Because the FDIC used a systemic risk exception to implement the guarantees, there is an implicit – albeit uncertain – message that the US regulators are willing to do the same for other institutions that present similar risk[7], if the situation arises. However, if the guarantees were explicit, this could induce more moral hazard in the banking system. This measure eased significantly depositor concerns – given that the depositors will bear no loss from the failures – and had a relatively low cost (0.3% of small bank deposits) that will be payed by a consortium of large banks (not the government).

[7] On Thursday, 16th of March, Treasury Secretary Janet Yellen said in a US Senate hearing about the crisis that depositors would only be insured fully on banks that regulators believed posed a big systemic risk.(Wilkie and C. Cox 2023)

The Bank Term Funding Program was also an important measure, albeit less so than the account guarantees. The emergency liquidity program had a positive impact on the public's view regarding balance sheet liquidity on weaker banks. Given that the collateral for the program was valued at par – not at the current market price – it essentially eliminated the need for a bank to sell securities at a loss in order to provide liquidity for possible outflows (which could lead to a loss of confidence in the bank and generate a run). However, the securities accepted as collateral for the loans were more limited than those accepted in the traditional discount window, so initially the program was less utilized than the traditional DW[8].

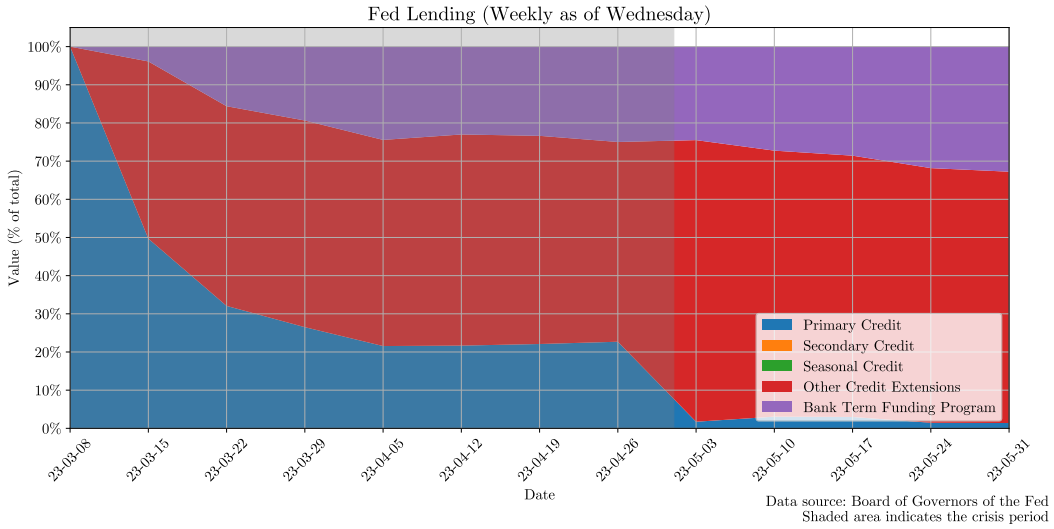

Figure 5.1: Fed lending data around the crisis period, values as percentage of total lending.

The BTFP is secured by good collateral and the Fed expected to not suffer any losses from the program, whose size ranged from 0.23% to 1.46% of small bank deposits during the crisis period. The market commentary indicates that the program was important to ease concerns about weaker banks with large mark-to-market losses on their securities portfolios[9], however, the purpose of the program is similar to the Discount Window and this seemed to be favored by the banks in the peak of the crisis, thus it was an effective measure but less so than the account guarantees for the failed banks.

In general, both measures act in complementary ways to ease depositor's concerns regarding the risk of their banking relationships. As per the FT: *"the risk of US bank runs was offset by deposit guarantees, new Federal Reserve*

[8]In the first week of the crisis, the amount being borrowed in the DW was more than 10 times the amount being borrowed via the BTFP.

[9]See Timiraos, Ackerman, and Duehren 2023 and J. Cox 2023.

Intervention	**Large banks pledge First Republic $30 billion in deposits**
Date	16/03/2023
Type	Hard / Ad-hoc capital injection.
Overview	11 large banks will inject $30bn in uninsured deposits in FRC, that must be held there for at least 120 days.
Objective	Provide more liquididy for FRC and boost depositor confidence.
Size/cost of intervention	$30 billion, equivalent to 0.578% of all deposits of small US commercial banks; 14.1% of all FRC assets at Q4 2022; 17% of FRC deposits at Q4 2022.
Market movement	Positive: FRC's stock rallied 47% when the news was released and ended the day up 10% from the day before.
Market commentary	Positive, however there were concerns that this could mean that the Regulators were unwilling to extend deposit guarantees any further.

liquidity facilities and a Wall Street whipround." (Jenkins 2023). Both measures were essential to ease concerns regarding the US financial system.

Regarding the US, major communication events by relevant authorities – when not accompanied by significant policy announcements – had no significant impact on market participants or depositors expectations, given the absence of attached policy measures. It is important to note, however, that communication, when attached to a policy measure, could improve the outcomes of the intervention by adjusting markets and depositors expectations.

In the 16th of March, 11 major US banks[10] collectively injected $30 billion of uninsured time deposits into First Republic Bank, in a move that aimed to strengthen liquidity in the troubled financial institution and boost depositor confidence in the system. FRC later announced that these deposits, alongside liquidity provided by the Fed – both via the BTFP and the DW –, provided the bank with ample liquidity and that it was already seeing a "considerable slowdown" in deposit outflow. The bank's stock rallied 47% on the news, after a drawdown of about 70% since the pre-crisis level. (Benoit et al. 2023)

This intervention is an ad-hoc capital injection, and it was lead by the US Treasury in conjunction with the participating banks, that provided the capital. This measure was focused on restoring the public's confidence in the bank and in the financial system as a whole – since this indicated that the larger banks were comfortable with their liquidity levels and accepted that the situation at FRC could be controlled – as well as providing relevant liquidity for the bank[11], alongside lending facilities from the Fed and the FHLB. This

[10]Bank of America Corporation, Citigroup Inc., JPMorgan Chase & Co., Wells Fargo, Goldman Sachs, Morgan Stanley, Bank of New York Mellon, PNC Bank, State Street, Truist, and U.S. Bank. (Pound 2023b)

[11]This injection represented 17% of FRC's deposits in Q4 22 and 28.7% (already including the $30 billion injection) of FRC's deposits in Q1 23.

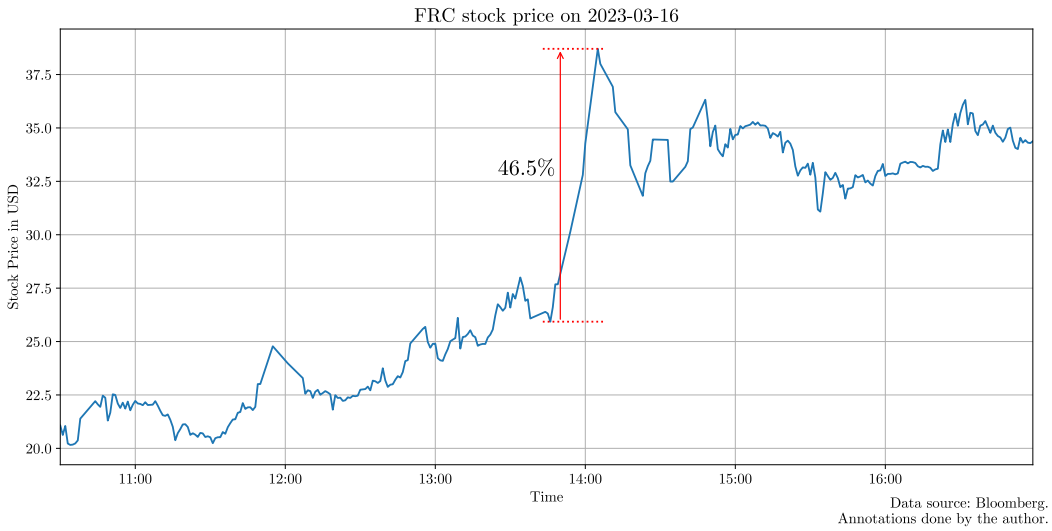

Figure 5.2: FRC's stock intraday move on the 16th of March, 2023.

was an effective measure led by regulators and implemented by the private sector, and had a small cost – since no deposits were lost in FRC. This is consistent with both the move in FRC's stock and market commentary after the announcement, with Nash et al. 2023 highlighting that: it was a creative solution that might negate the need of a broader deposit guarantee by the government; and it had *"potential to mitigate future bank runs while demonstrating the nation's largest banks feel comfortable about their liquidity and capital"*.

Given the industry's commentary, it appeared to have worked accordingly. Although FRC failed eventually – was put into receivership and subsequently bought by JPMorgan –, it would take 2 months for it to happen and it did not present the same systematic risk as the failures of SVB, SBNY and Credit Suisse.

In Europe, the hard interventions used in the crisis were mostly directed towards Credit Suisse and the implications that its failure or improper wind-down could have on the Swiss and the European financial system.

The first hard measure used in Europe was the announcement on the 15th of March that the Swiss central bank (the SNB) would provide liquidity to CS if necessary, but that it did not believe the episode in the US imposed a big contagion risk on the Swiss financial system. (The Swiss National Bank 2023b) This announcement also serves the purpose of indicating that the central bank is monitoring the state of the financial institution and that it believes in its long term sustainability. (Levine 2023) In the morning of the following day, CS announced it would borrow up to CHF 50 billion from the SNB in order to

Intervention	**SNB announced and provided liquidity for CS**
Date	15/03/2023 and 16/03/2023
Type	Hard / Ad-hoc emergency lending.
Overview	SNB announced on the 15th that it would provide liquidity lines to CS, if necessary. Although it did not view the events in the US as causing a contagion risk on Swiss financial institutions. On the 16th, CS announced it would borrow CHF 50 billion from the SNB.
Objective	"Pre-emptively strengthen liquidity" at CS, given outflows caused by the episode in the US.
Size/cost of intervention	Up to CHF 50 billion (around $54 billion USD).
Market movement	Positive: CS's stock rose 30% after the announcement on the 16th.
Market commentary	Positive overall at the time of the announcement.

"pre-emptively strengthen liquidity". This was important given the significant reported outflows after the episode in the US.

Overall market response was positive to the emergency lending intervention, with CS's stock going up 30% on the news. It was understood as a show of confidence in CS by the SNB, and it also provided the bank with an ample liquidity cushion for future outflows[12]. Even though this intervention could be classified as successful in the day after its announcement, the bank's stock still suffered losses in the following days.

It was reported by Morris, Fontanella-Khan, and Massoudi 2023, however, that the regulator's plan was to use this intervention as a way to calm the markets until a deal was made for UBS to buy or incorporate its troubled competitor, Credit Suisse. The merger, officially announced on the weekend of the 19th, was an intervention that involved several different measures, including capital restructuring, guarantees of certain liabilities and lending to the involved parties.

In the capital restructure side, CHF 16 billion of Additional Tier 1 capital were written down to zero using a lesser-known provision in their contracts[14], as well as CS being incorporated into UBS, the surviving entity of the merger. In terms of guarantees, the government and UBS agreed to a loss protection agreement, where it provides UBS with a CHF 9 billion backstop to losses greater than CHF 5 billion that arised from the CS assets and their integration

[12]Given deposits of CHF 234 billion in the end of 2022, the CHF 50 billion announced would represent over 20% of deposits.

[13]See Winters and Balezou 2023.

[14]Regulators wrote it down using an emergency provision. This, however, left AT1 bondholders unsatisfied, since AT1 capital is higher up in the capital structure than equity, suffering losses only after equity has been written down or if capital ratios are substantially low (and none of these was the case).

Intervention	**Credit Suisse's acquisition and restructuring**
Date	19/03/2023
Type	Hard / Restructuring, Guarantee, Lending.
Overview	The Swiss regulator orquestrated a merger between UBS and CS, and allowed it to happen without shareholder approval. CS was bought by around $3bln. As a part of the deal, the government provided a CHF 9bln backstop to UBS's possible losses with the acquisition, SNB provided CHF 100bln in liquidity for UBS, and AT1 notes totalling CHF 16bln were written down to zero.
Objective	End the crisis of confidence that was present in CS, driving deposit outflows, and lower the risk of banks runs and contagion in the financial system.
Size/cost of intervention	CHF 100bln in liquidity provisions and CHF 9bln in a backstop for losses that both ended voluntarely in 08/11/23, with no taxpayer losses[13]; CHF 16bln of AT1 capital written down to zero.
Market movement	Positive for markets as a whole and neutral to UBS.
Market commentary	Generally positive, although noting that the outcome was not favorable for bond and equity holders of Credit Suisse.

with UBS. Regarding lending, the SNB provided a liquidity backstop of CHF 100 billion to UBS and to CS in order to provide access to the liquidity that might be necessary (The Swiss National Bank 2023c).

Market commentary was well summarized by a statement released by the SNB at it's Monetary policy assessment of 23 March 2023: *The past week has been marked by the events surrounding Credit Suisse. The measures announced at the weekend by the federal government, FINMA and the SNB have put a halt to the crisis.* (The Swiss National Bank 2023a).

Reactions on asset prices were favorable in general, with US and European stocks trading higher and a marginal increase in the CDS for UBS's medium term debt, to a level comparable to other European peers (Ostroff 2023). This indicates that the market had confidence that UBS would be able to incorporate CS without generating big additional risks to their business, easing concerns of a crisis in the financial system.

The intervention that marked the end of the crisis in the US took place more than 1 month after the beginning of the episode, the 1st of May, 2023. Even though contagion fears were already low, and deposit outflows from small banks had already fully stopped, as can be seen in 4.4, First Republic was still a concern for regulators given that it most likely would have had troubles being a going concern as a company. The solution found by the FDIC was a sale of the bank to another institution, with the winner bid being from JP Morgan. In the day after the sale was decided, the FDIC put FRC into receivership and it was incorporated into JPM[15]. (Ensign and Eisen 2023)

[15]Since the bank was taken over by the FDIC, shareholders and bondholders did not participate in the transaction.

Intervention	**First Republic was taken over by the FDIC and sold to JPM**
Date	01/05/2023
Type	Hard / Restructuring
Overview	First Republic Bank was put on sale over the weekend by the FDIC, with the winner bid being from JP Morgan. On Monday, May 1st, the FDIC put FRC into receivership and it was sold almost entirely to JPM. The FDIC aggred to share potential losses on FRC's loan book and to provide a $50 billion fixed rate 5-year loan to JPM.
Objective	Terminate the last cause of potential stress for the banking system after the failures of SVB and Signature.
Size/cost of intervention	The FDIC estimated that the transaction would cost the DIF $13 billion (11.2% of the DIF balance as of the end of Q1 2023).
Market movement	Neutral, with the S&P 500 down about 0.1%.
Market commentary	Positive

Overall market response was positive in terms of the crisis of confidence generated by the earlier banking failures. This is likely motivated by the fact that JP Morgan is the largest consumer bank in the US, with both a very well established and resilient deposit base and a large enough size that FRC does not represent a big portion of its balance sheet[16]. However, asset prices had a neutral response to the intervention, with the S&P 500 index down about 0.1%. JP Morgan's stock price climbed 2.1% in an idiosyncratic move, on the prospect of the addition of a wealthy customer base and discounted assets. (Dezember 2023)

[16]The $90 billion in FRC deposits that were absorbed by JPM represents roughly 3.8% of the bank's average deposits on Q1 2023.

6

Conclusion

The most important interventions to prevent a widening of the banking stress were the hard measures that took place in the beginning of the crisis, in the week immediately following the failures of SVB and Signature.

In the US, the most important measures were the account guarantees for the failed banks and the injection of deposits from large banks into FRC. Both measures induced overall positive commentary from market participants and indicated a significant easing in concerns about a broadening of the crisis. They were also not very large in terms of volume, with the combined approximate size of both being under 1% of deposits of small banks in the period. Its worth noting that these measures involved mechanisms that were not present before the crisis, unlike the BTFP which was similar to the Discount Window – and thus initially less adopted, although it was well received by market participants.

We also note that soft measures, such as communication events by relevant authorities had no significant impact on either market prices or commentary, when they were not directly associated with a hard policy measure.

In Europe, the most important measure was the takeover of CS by UBS, effectively ending the crisis of confidence regarding Credit Suisse. This was a larger intervention than those in the US, and a more controversial one due to the write-off of AT1 notes of the bank, but it ended with no losses being borne by the taxpayer and no large additional risk being incurred by UBS. Although this intervention is similar to the FRC takeover and sale in the US, it was more effective than the ladder in containing the spread of the crisis because it happened in the midst of first week, when there was still lots of uncertainty around the situation of CS. With FRC, the sale was less motivated by a fear of the contagion of stress but because the business model had become unsustainable given the outflows it had received, and the only logical solution was for it not to operate as a sepate entity.

In general, the most effective measures were the hard interventions that were tailor made to the situation, such as the account guarantees and capital injection done by the private sector in the US and the CS merger with UBS in Europe. Although the emergency liquidity programs provided by central

banks, either ad hoc or broad based, were received by positive commentary and positive reactions by the markets, they were not the main drivers for the easing of the crisis.

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